Oct. 27, 1959 C. L. STROUP ET AL 2,910,560

CURRENT-INTERRUPTING APPARATUS

Filed Oct. 19, 1956 4 Sheets-Sheet 1

FIG. 1

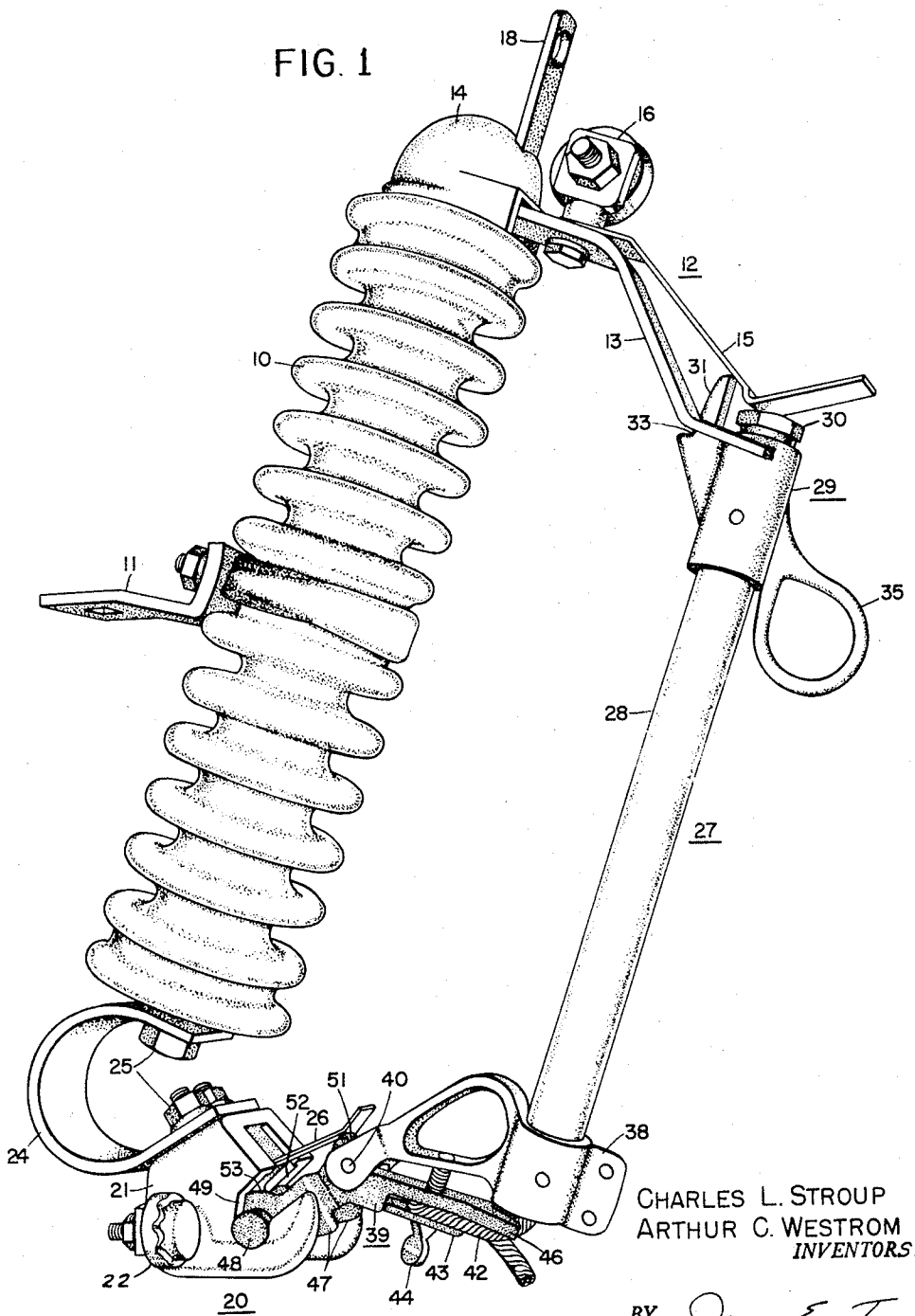

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FIG. 2.

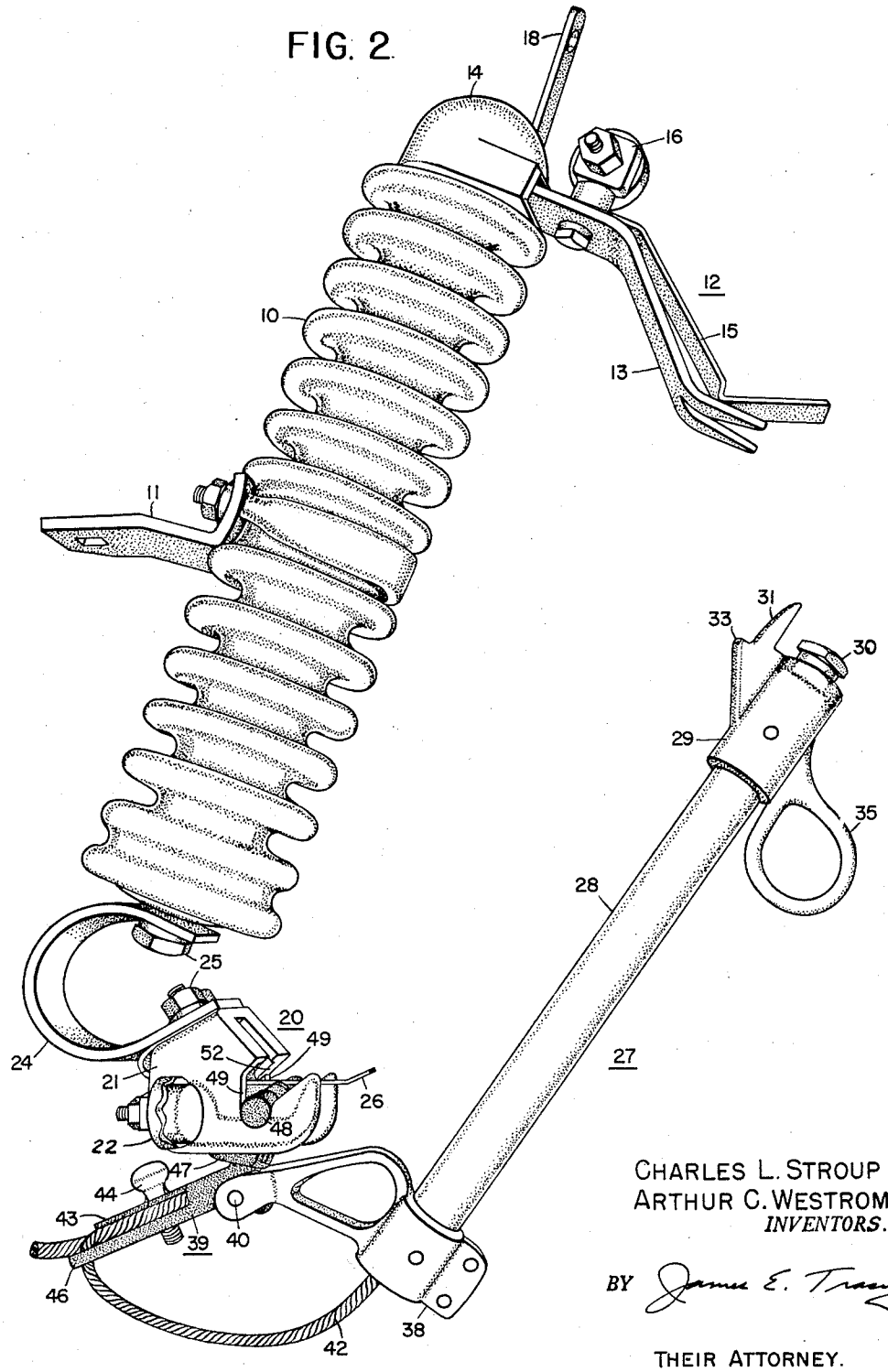

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FIG. 3

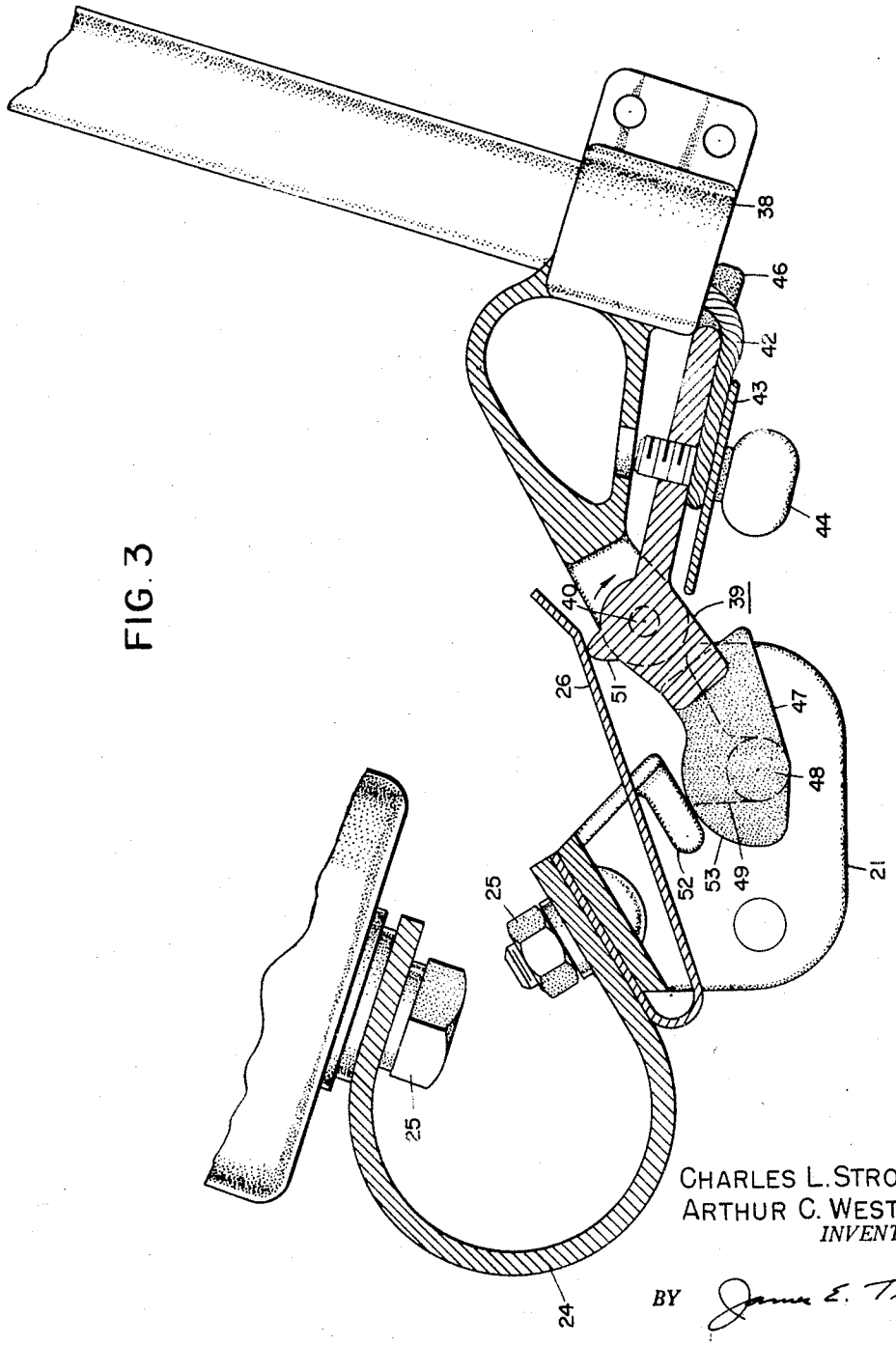

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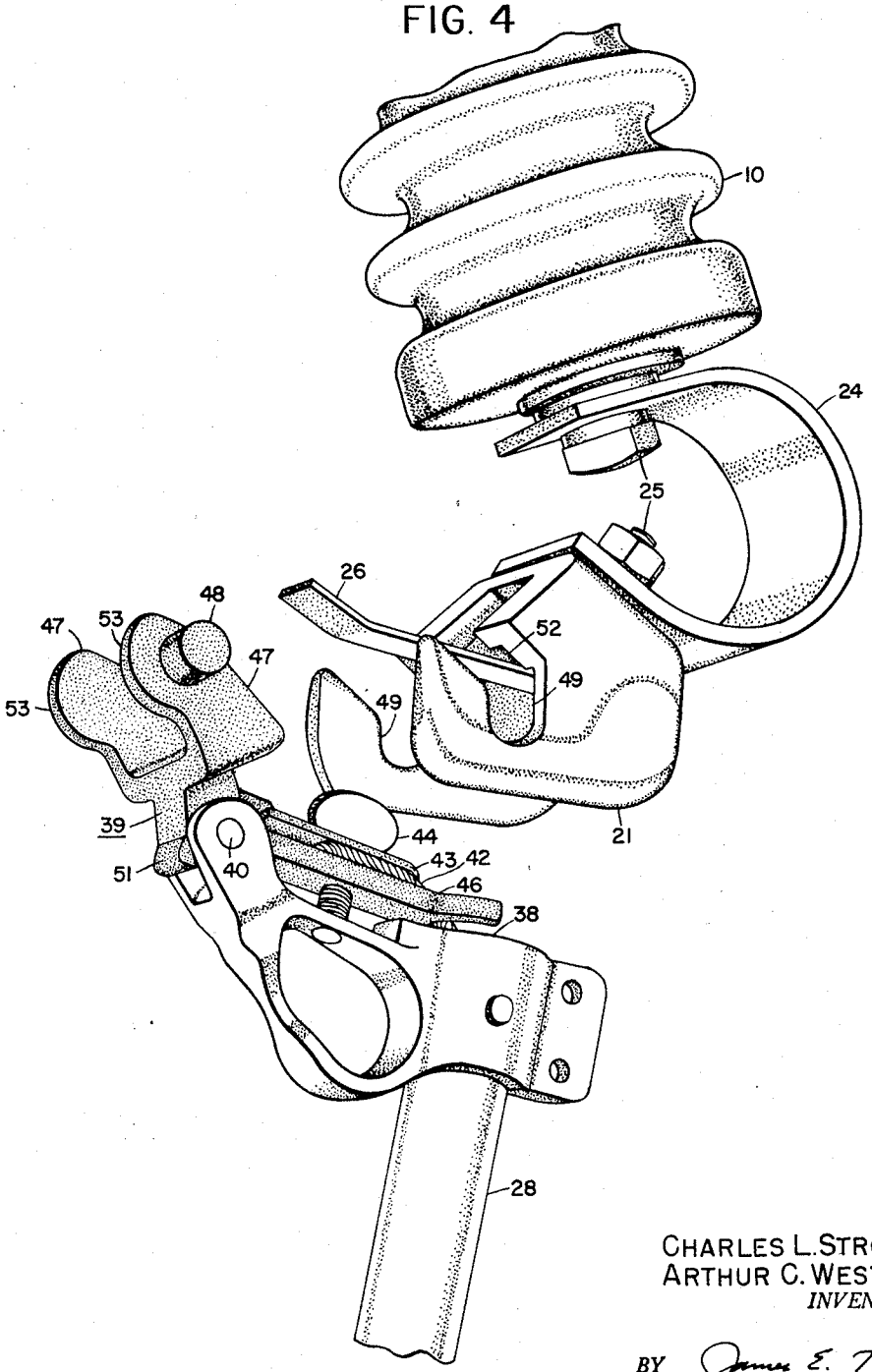
FIG. 4



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2,910,560

CURRENT-INTERRUPTING APPARATUS

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Application October 19, 1956, Serial No. 617,008

13 Claims. (Cl. 200—114)

This invention relates to current-interrupting apparatus, particularly of the drop-out fuse cutout type, for successfully interrupting or clearing relatively high fault currents.

One conventional drop-out fuse cutout comprises a cylindrically shaped insulator with upper and lower stationary terminals secured to opposite ends thereof. A fuse tube having upper and lower ferrules is pivotally mounted to the lower terminal by means of a toggle member rotatably connected to the lower ferrule so that the upper ferrule may engage and latch with the upper terminal. A fuse link is included within the fuse tube and a flexible lead extending therefrom and through a vent in the lower end of the tube is fastened to the toggle member to prevent relative rotation between the toggle member and the fuse tube. A closed circuit is established from the upper terminal through the upper ferrule, fuse link, flexible lead and toggle member to the lower terminal.

When the fuse link ruptures or melts due to excessive current flow therethrough, the lower end of the link immediately separates from the upper end. Arcing occurs between the spaced-apart ends and the heat of the arc initiates the production of gaseous products from the internal lining of the fuse tube which extinguish the arc. The arc and gaseous products create a relatively high pressure within the fuse tube which discharges out the lower vent or opening in the tube. The toggle member is released when the fuse link blows, since the flexible lead is no longer anchored to the upper ferrule, causing the fuse tube to drop down.

Such a conventionally constructed fuse cutout is effective to interrupt fault currents but it is limited by certain factors as to the maximum current that it can successfully interrupt or clear without damaging or destroying the fuse cutout itself. In the first place, the higher the fault current the greater the arc developed and thus the greater the pressure built up wthin the fuse tube. The tube must be capable of withstanding the high pressure and this may be assured by reinforcing it with a material of high mechanical strength, such as Bakelite. It is desirable that the tube have a small bore or relatively small inner diameter so that the arc developed responsive to blowing is in extremely close proximity to the internal lining of the tube and greatly confined within the tube. In this way, the gaseous products and the arc are more rapidly and efficiently expelled from the tube. A larger bore would result in a longer arc-extinguishing interval, which of course is undesirable.

Thus, it is advantageous when a fuse cutout is likely to be subjected to relatively high fault currents to incorporate a reinforced small bore fuse tube in the fuse cutout. However, even though the fuse tube may be constructed to withstand tremendous fault current without bursting, damage may be inflicted on elements of the fuse cutout because of the recoil action of the fuse tube that results from the arc and gaseous discharge out the vent. The fuse tube may be likened to a gun barrel or jet-

propelled device during the arc-extinction and discharge interval. The force of discharge in a downward direction produces an equal and opposite reaction in the upward direction which tends to physically move the fuse tube toward the upper terminal with relatively great force. Quite often the force is sufficient to damage or destroy portions of the fuse cutout. Of course, it is possible to employ a vent at each end of the fuse tube but any gases discharged out the top vent are likely to inflict damage on conductors or equipment located over the fuse cutout. Moreover, such a dual-vent tube inherently fails to produce adequate internal pressure required for the interruption of the lower magnitude fault currents.

With the continually increasing loads that the electric utility companies must satisfy today, there is an urgent need for an economically constructed fuse cutout which employs a small-bore, single-vented tube and yet which will withstand the tremendous recoil or expulsion force resulting from the interruption of high amplitude fault current without suffering any damage to the cutout. To this end, the present invention is addressed to a new and improved current-interrupter that will achieve those very desirable results.

Accordingly, it is an object of the present invention to provide improved current-interrupting apparatus which successfully clears relatively high fault currents without resulting in any damage to the apparatus, and still efficiently interrupts currents of a relatively low amplitude.

It is another object of the invention to provide current-interrupting apparatus including a fuse tube assembly which is subject to recoiling during the arc-extinguishing interval wherein the recoil movement of the tube is rendered ineffective insofar as damage to the current-interrupting apparatus is concerned.

It is a further object to provide current-interrupting apparatus including a fuse tube assembly that recoils as an undesired incident to the arc development and extinction process wherein the recoil movement is absorbed so that it is not transferred in any material degree to other portions of the apparatus.

It is still another object of the invention to provide current-interrupting apparatus of the drop-out fuse cutout type where the fuse tube assembly is effectively in locked engagement with the lower terminal when the assembly is in the closed-circuit position in order that any recoil movement of the fuse tube assembly may be directly transferred to the lower terminal.

Current-interrupting apparatus, constructed in accordance with the invention, comprises an insulator and first terminal apparatus secured to one end of the insulator. There is second terminal apparatus and a spring device resiliently connecting the other end of the insulator to the second terminal apparatus. A fuse tube assembly is provided for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough. Means included in the fuse tube assembly pivotally mounts one end of the fuse tube assembly on the second terminal apparatus so that the other end of the fuse tube assembly may be positioned into engagement with the first terminal apparatus to establish a closed circuit between the first and second terminal apparatus through the fuse link. Finally, the current-interrupting apparatus has means included in the fuse tube assembly which responds to the rupturing of the fuse link for extinguishing any arc produced by the ruptured fuse link, the fuse tube assembly recoiling during the arc-extinguishing interval and the spring device absorbing such recoil movement.

The features of this invention which are believed to be new are set forth with particularity in the appended claims. The invention itself, together with further objects and advantages thereof, may best be understood,

however, by reference to the following description when taken in conjunction with the accompanying drawings, in which:

Figure 1 illustrates a drop-out fuse cutout, in its closed-circuit position, constructed in accordance with the invention;

Figure 2 shows the same fuse cutout of Figure 1 immediately subsequent to the clearance of a fault and in the process of dropping out;

Figure 3 is an enlarged, sectional view of a portion of the fuse cutout of Figure 1; and,

Figure 4 is an exploded view of a portion of the fuse cutout of Figure 1 from a different aspect.

Considering now the construction of the illustrated fuse cutout, an insulator **10** is provided with a mounting bracket assembly **11** for mounting the fuse cutout on a cross arm of a utility pole. Upper terminal apparatus **12** is secured to the top end of insulator **10** in cantilever fashion. Apparatus **12** includes a spring member **13**, one end of which is rigidly secured to insulator **10** beneath a plastic bird guard **14** and the other end of which is free and has a V-shaped opening. A contact spring **15**, preferably made of silver plated Phosphor bronze, generally parallels spring member **13** and is attached thereto by means of transformer type terminal mechanism **16** which also receives and establishes an electrical connection to a line conductor (not shown). A snubbing ring **18** is also rigidly secured to the top of insulator **10** and projects upwardly through bird guard **14**.

Lower terminal apparatus **20** includes an inverted U-shaped hinge casting **21**, formed preferably of brass. A transformer type terminal connector **22** is mounted on hinge casting **21** to receive the other line conductor (not shown). Apparatus **20** is resiliently connected to the lower end of insulator **10** through a resilient member in the form of a curved flat spring **24**. Spring device **24** is rigidly held to insulator **10** and hinge casting **21** by means of bolts and nuts **25**. Elements **24** and **25** may collectively be considered as shock-absorbing means. Terminal apparatus **20** also includes a silver plated spring contact **26** which is rigidly affixed to hinge casting **21** by means of the bolts and nuts **25** connecting casting **21** and spring device **24** together, as is clearly shown in Figure 3.

A fuse tube assembly or circuit interrupter **27** of the arc-extinguishing type includes a fuse tube **28** that is preferably lined internally with horn fibre and fibre glass reinforced externally for mechanical bursting strength. An upper ferrule **29** preferably made of brass is secured to the top of tube **28** and a silver plated ferrule plug **30** is threaded into ferrule **29**. Tube **28** is adapted to receive a fuse link (not shown) within its bore and the upper or button end of such a link is internally secured to ferrule **29**. Ferrule **29** has an upward projection **31** which engages contact spring **15**. A shoulder **33** is formed in the ferrule to mate with spring member **13** when the fuse cutout is in its closed-circuit condition, as shown in Figure 1, in order to restrain upward movement of fuse tube assembly **27**. Ferrule **29** also has an eye **35** to receive the prong of a switch stick for the purpose of manually manipulating assembly **27** into or out of the closed-circuit position.

A lower brass ferrule **38** is rigidly secured to the bottom end of tube **28** and a toggle member **39** is rotatably connected to ferrule **38** by virtue of a pin **40**. In the closed circuit position of fuse tube assembly **27**, a flexible lead **42** extends through the vent of tube **28** from the lower end of the fuse link and is secured to toggle member **39** by means of a turn-proof washer **43** and a hand operated screw **44**. This prevents any rotation of member **39** relative to ferrule **38**, since in this position portion **46** of toggle **39** butts up against ferrule **38**.

Toggle member **39** has two parallel legs **47**, each of which has a trunnion **48** adapted to mount in an assigned one of two slots **49** provided in U-shaped hinge casting **21**. Such construction is clearly shown in Figure 4. In the closed-circuit position of fuse tube assembly **27**, spring contact **26** engages and exerts pressure on a projection **51** formed on toggle **39** to produce a bending moment, with pin **40** as a fulcrum, in a direction shown by the arrow in Figure 3. Contact spring **15** also produces the same bending moment, and thus springs **26** and **15** together effectively establish a constant downward tension on lead **42**. When flexible lead **42** is securely tied to toggle **39**, as is shown in Figures 1 and 3, fuse tube assembly **27** is effectively rigidly held together. The trunnions **48** are slidably mounted in slots **49** of casting **21** so that the assembly may be swung into the closed-circuit position of Figure 1. Projection **31** of upper ferrule **29** latches into engagement with contact spring **15** in order to retain fuse tube assembly **27** in the closed-circuit position.

Hinge casting **21** also has two projections **52** on its internal surface extending toward each other. This feature is perhaps best shown in Figure 4. These projections are provided to engage and lock with cam surfaces **53** of toggle member **39** when fuse tube assembly **27** is in the closed-circuit position. Figure 3 clearly illustrates the manner in which toggle member **39** is locked to projections **52** to prevent relative movement between fuse tube assembly **27** and hinge casting **21**. With this arrangement, any movement of assembly **27** will be directly transferred to hinge casting **21**.

In the operation of the fuse cutout, under normal conditions (namely, in the absence of fault current) and when the fuse cutout is in the closed-circuit position, that is, when circuit interrupter or fuse tube assembly **27** is in its bridging position as shown in Figure 1, an electrical circuit is provided for the flow of power current via the following path: connector **16**, contact spring **15**, upper ferrule **29**, fuse link, flexible lead **42**, contact spring **26** and toggle **39**, hinge casting **21** and connector **22**. In response to excessive current flowing through this circuit, the fuse link melts or blows which instantaneously results in the production of an arc between the two ends of the link since there is then a considerable potential difference therebetween. The horn fibre lining of tube **28** responds to the heat of the arc to produce deionizing water vapor and other gases that immediately react with the arc to extinguish or expel it. A radial bursting pressure is developed from the gaseous products within the tube bore during such arc-extinguishing interval. The fibre glass reinforcing external sleeve of tube **28** prevents the tube from bursting. The internal pressure built up is relieved by the vent in the lower end of the tube, thereby effectively discharging the gaseous products throughout the arc-extinguishing interval with a resulting production of an expulsion force in the direction of the longitudinal axis of fuse tube assembly **27**.

Such a gaseous discharge is analogous to a jet action or the firing of a gun in that there is an equal recoil reaction in the opposite direction. Fuse tube assembly **27** thus recoils in a direction toward upper terminal apparatus **12**. Spring member **13** tends to restrain and partially absorb this recoil movement as it serves as a stop for shoulder **33** of upper ferrule **29**. However, in accordance with one of the salient features of the present invention, the recoil movement is primarily absorbed by spring device **24** which compresses or yields in a direction substantially parallel to the longitudinal axis of fuse tube assembly **27** as assembly **27** moves upwardly along its longitudinal axis. It will be remembered that in the closed-circuit position, which is the position during the arc-extinguishing interval, assembly **27** is effectively rigidly connected to one end of spring device **24** by virtue of cam locking surface **53** of toggle **39**. This insures that the recoil movement resulting from the expulsion force is transferred to curved flat spring **24** for absorption.

Subsequent to the extinction of the arc and the gaseous discharge, flexible lead **42** is pulled out of the bore of

tube 28, since it is no longer anchored to ferrule 29 through the fuse link and since it is under a constan downward tension, and spring contacts 26 and 15 cooperate to effect rotation of toggle 39 in the direction of the arrow in Figure 3 because of the pressure exerted on projections 51 and 31, respectively. Trunnions 48 therefore rotate; spring contact 26 continues to exert pressure on projection 51 and consequently lower ferrule 38 through pin 40, and therefore fuse tube assembly 27 drops down and out as is clearly shown in Figure 2.

The invention provides, therefore, current-interrupting apparatus having a fuse tube assembly of the arc-extinguishing type which is subject to being propelled by recoil action where the recoil movement is absorbed by means of a uniquely arranged spring device.

While a particular embodiment of the invention has been shown and described, modifications may be made, and it is intended in the appended claims to cover all such modifications as may fall within the true spirit and scope of the invention.

We claim:

1. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said spring device compressing to absorb such recoil movement.

2. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis toward said first terminal apparatus and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said spring device compressing to absorb such recoil movement.

3. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible flat spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said flat spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said flat spring device compressing to absorb such recoil movement.

4. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible curved flat spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position and said fuse tube assembly being engaged with said second terminal apparatus in the closed-circuit position such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal ap-

paratus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said curved flat spring device compressing to absorb such recoil movement.

5. Current-interrupting apparatus comprising: an insulator; upper terminal apparatus secured to one end of said insulator; lower terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said lower terminal apparatus, said spring device compressing responsive to movement of said lower terminal apparatus in a predetermined direction; an elongated fuse tube assembly having an upper and a lower end for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting the lower end of said fuse tube assembly on said lower terminal apparatus so that the upper end of said fuse tube assembly may be positioned into engagement with said upper terminal apparatus to established a closed circuit between said upper and lower terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said lower terminal apparatus for providing a substantially locked engagement of said lower end of said fuse tube assembly and said lower terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said lower terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said lower terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said spring device compressing to absorb such recoil movement.

6. Current-interrupting apparatus comprising: an insulator; upper terminal apparatus secured to one end of said insulator; lower terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said lower terminal apparatus, said spring device compressing responsive to movement of said lower terminal apparatus in a predetermined direction; a fuse tube assembly including a fuse tube having an internal bore closed at its upper end and open at its lower end for receiving an elongated fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting the open end of said fuse tube on said lower terminal apparatus so that the closed end of said fuse tube may be positioned into engagement with said upper terminal apparatus to establish a closed circuit between said upper and lower terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said lower terminal apparatus for providing a substantially locked engagement of said fuse tube assembly and said lower terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said lower terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for producing gaseous products within said fuse bore to extinguish any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis in a direction toward said upper terminal apparatus and said lower terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval as the gaseous products are discharged out the open end of said fuse tube and said spring device compressing to absorb such recoil movement.

7. Current-interrupting apparatus comprising: first terminal apparatus including a spring member secured to one end of said insulator; second terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position and said spring member restraining movement of said fuse tube assembly in a direction toward said first terminal apparatus; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis in a direction toward said first terminal apparatus and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said spring device compressing to absorb such recoil movement.

8. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and with said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said second

terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and such recoil movement being transferred to said spring device through said second terminal apparatus for absorption by said spring device because of the locked engagement of said fuse tube assembly with said second terminal apparatus.

9. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said second terminal apparatus, said spring device compressing responsive to movement of said second terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; a toggle member included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position and said toggle member having a cam surface adapted to mate with a surface of said second terminal apparatus to substantially lock said fuse tube assembly to said second terminal apparatus in the closed-circuit position to restrain relative movement therebetween such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said second terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said second terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and such recoil movement being transferred to said spring device through said second terminal apparatus for absorption by said spring device because of the locked engagement of said toggle member with said second terminal apparatus.

10. Current-interrupting apparatus comprising: an insulator; upper terminal apparatus secured to one end of said insulator; lower terminal apparatus; a compressible spring device resiliently connecting the other end of said insulator to said lower terminal apparatus, said spring device compressing responsive to movement of said lower terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough having a longitudinal axis and including rigidly secured upper and lower ferrules and a toggle member pivotally connected to said lower ferrule and arranged to be held in a locked position by said fuse link, said toggle member also being pivotally mounted on said lower terminal apparatus so that said upper ferrule may be positioned into engagement with said upper terminal apparatus, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position and said toggle member and said lower terminal apparatus including means for providing a substantially locked engagement therebetween in the closed-circuit position to restrain relative movement between said fuse tube assembly and said lower terminal apparatus; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said lower terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and said spring device compressing to absorb such recoil movement because of the locked engagement of said fuse tube assembly with said lower terminal apparatus.

11. Current-interrupting apparatus comprising: an insulator; upper terminal apparatus secured to one end of said insulator; lower terminal apparatus having a pair of spaced-apart parallel portions each of which has a slot; a compressible spring device resiliently connecting the other end of said insulator to said lower terminal apparatus, said spring device compressing responsive to movement of said lower terminal apparatus in a predetermined direction; an elongated fuse tube assembly for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough and having a longitudinal axis; a toggle member included in said fuse tube assembly having a pair of oppositely extending trunnions slidably mounted in said slots to permit pivoting of said fuse tube assembly into engagement with said upper terminal apparatus to establish a closed circuit between said upper and lower terminal apparatus through said fuse link, the longitudinal axis of said fuse tube assembly being substantially parallel with said predetermined direction in the closed-circuit position and said toggle member also having a pair of cam surfaces engaging a corresponding pair of cam-locking surfaces on said spaced-apart parallel portions of said lower terminal apparatus in the closed-circuit position effectively to rigidly connect said fuse tube assembly to said lower terminal apparatus and said spring device such that any independent movement of said fuse tube assembly along said longitudinal axis is transferred to said spring device through said lower terminal apparatus; and means included in said fuse tube assembly responsive to the rupturing of said fuse link for extinguishing any arc produced by the ruptured fuse link, said fuse tube assembly recoiling along said longitudinal axis and said lower terminal apparatus recoiling in said predetermined direction during the arc-extinguishing interval and such recoil movement being transferred to said spring device through said lower terminal apparatus for absorption by said spring device because of the locked engagement of said cam surfaces of said toggle member with said cam-locking surfaces of said lower terminal apparatus.

12. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; shock-absorbing means connecting the other end of said insulator to said second terminal apparatus; an elongated fuse tube assembly, having a longitudinal axis, for receiving a fuse link adapted to rupture in response to the translation of excessive current therethrough, said fuse tube assembly producing an expulsion force in the direction of its longitudinal axis upon rupturing of said fuse link; means included in said fuse tube assembly pivotally mounting one end of said fuse tube assembly on said second terminal apparatus so that the other end of said fuse tube assembly may be positioned into engagement with said first terminal apparatus to establish a closed circuit between said first and second terminal apparatus through said fuse link; means included in said fuse tube assembly and said second terminal apparatus for providing a substantially locked engagement of said one end of said fuse tube assembly and said second terminal apparatus in the closed-circuit position such that any independent movement of said fuse tube assembly substantially along said longitudinal axis resulting from said expulsion force is transferred to said shock-absorbing means through said second terminal apparatus; and a resilient member, included in said shock-absorbing means, yieldable in a direction substantially parallel to the longitudinal axis of said fuse tube assembly in the closed-circuit position for absorbing said expulsion force.

13. Current-interrupting apparatus comprising: an insulator; first terminal apparatus secured to one end of said insulator; second terminal apparatus; shock-absorbing means connecting the other end of said insulator to said second terminal apparatus; an elongated circuit interrupter, having a longitudinal axis, mounted on said second terminal apparatus for pivotal movement into and out of a bridging position for electrically interconnecting said first and second terminal apparatus, said circuit interrupter exerting a force on said second terminal apparatus during circuit interruption in a direction substantially parallel to said longitudinal axis; and a compressible resilient member, included in said shock-absorbing means, for absorbing said force.

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